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Final Report
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Project Title: Origin, transport and fate of nutrients and phytoplankton in the seaward jets of the coastal transition zone

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Repeated surveys off northern California during 1987 and 1988 provided high resolution tracks of nutrients, chlorophyll and phytoplankton species that enabled us to understand the chemical and biological consequences of the energetic jets and eddies of the Coastal Transition Zone (CTZ). During the final period of this grant we completed data editing and preparation of papers and data reports. Because of the voluminous data collected on seven cruises during 1987 and 1988: 1) 10,000 surface nitrate (per cruise) and surface fluorescence (three cruises), 600 discrete water column samples for nutrients and chlorophyll (per cruise), 25 phytoplankton species samples (per cruise) with an average of 40 species per sample, the data reports were a major effort. We have distributed the data to researchers at Oregon State (Kosro, Huyer, Strub, Paulson), Scripps (Hayward) and Old Dominion (Hoffman).

CTD surveys during 1987 and 1988 focused on the coastal transition zone off northern California, the area between the narrow and productive coastal upwelling zone (about 25 km wide in the area of the study) and the extensive oligotrophic central gyre. The surveys encountered strong baroclinic jets that were evident in both the ADCP and hydrographic data. During June and July 1988 a filament with higher surface nitrate, higher chlorophyll, abundant populations of neritic centric diatoms and higher rates of primary production was evident perpendicular to the coast off Point Arena and Point Reyes. The filament was found through the survey grid which extended to 250 km from shore. The width of the feature was on the order of 75 km. High nutrient, high phytoplankton areas, dominated by neritic diatom communities, were found to the south and inshore of the baroclinic jets. The strong baroclinic jets were found to transport water with low nutrient content and apparently do not transport significant levels of recently upwelled, high nutrient water to the ocean interior. To the north and offshore of the jets the surface waters were warmer, had low nutrient levels, low chlorophyll and were populated by small solitary phytoplankton characteristic of oceanic waters. The jets were only partially imbedded in the high nutrient, high chlorophyll, diatom dominated waters and showed characteristics of the two ecosystems. It can be inferred that the phytoplankton populations to the south of the jet were supported by upwelling of new nutrients resulting from dynamic processes associated with a meandering jet.

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During 1988 the filament was present when the survey sequence began but then decayed after a month. The surface and subsurface nitrate fields were very coherent with the dynamic topography field throughout the survey sequence; however, the surface and integrated chlorophyll fields were coherent only through the first two surveys. A decrease in phytoplankton biomass began during the third survey coincident with physical changes which occurred in that time frame: 1) an intensification of the undercurrent and 2) changes in the surface circulation from predominantly offshore to predominantly longshore. Understanding the processes responsible for the dramatic decreases in phytoplankton stocks is paramount for realistic biological models of this region.

The work carried out during this grant period contributed to new insights on the circulation of the California Current System by using nitrate concentration as a tracer; described the primary consequences that circulation has for nutrients, phytoplankton biomass and primary production; showed that the strong jets of the Coastal Transition Zone transport water with relatively low levels of nutrients and phytoplankton; and showed that there is strong shoaling of the nutricline on the inshore or southern side of the jets indicating that there is significant nutrient supply in the surface layers in these regions.

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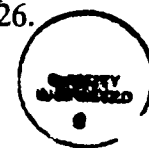
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